

The impact of housing conditions on excess winter deaths

Britain has around 40,000 more deaths in winter than expected from death rates in other months of the year. Looking at England, this study investigated whether this large winter excess of deaths could in part be attributed to poorly insulated and difficult-to-heat housing. The study, by researchers from the London School of Hygiene & Tropical Medicine, found:

f There was a 23 per cent excess of deaths from heart attacks and strokes during winter (December to March) compared with non-winter months. Much of this can be attributed to cold. The winter rise in deaths was greatest in older people, but there was some rise at all ages. The risk of excess winter death showed little variation with socio-economic group.

f The magnitude of the winter excess was greater in people living in dwellings that appear to be poorly heated. The percentage rise in deaths in winter was greater in those dwellings with low energy-efficiency ratings, and those predicted to have low indoor temperatures during cold periods. There was also a gradient of risk with age of the property, the risk being greatest in dwellings built before 1850, and lowest in the more energy-efficient dwellings built after 1980. Absence of central heating and dissatisfaction with the heating system also showed some association with increased risk of excess winter death.

f The indoor temperature in many dwellings appears to fall below 16° Celsius during cold periods. Low indoor temperatures were found to be more likely if the dwelling was old, had no or inadequate central heating, was costly to heat, or was occupied by a household with low income. People in local authority or housing association dwellings appeared to be especially likely to have low indoor temperatures during cold periods if their heating costs were high.

f Although there is some uncertainty about the risk estimates, there was evidence that cold-related mortality was greater in homes predicted to have low indoor temperatures during cold spells.

f The findings suggest that people in poorly heated homes are indeed more vulnerable to winter death than those living in well-heated homes. This suggests that substantial public health benefits can be expected from measures that improve the thermal efficiency of dwellings and the affordability of heating them.

Britain has a large winter excess of deaths - some 40,000 more deaths during December to March than expected from death rates in other months of the year. Although influenza, respiratory infections and other seasonal factors may account for part of the winter excess in mortality, around 60 per cent of it can be attributed to the effects of cold. This winter excess is greater than in most other countries of continental Europe and Scandinavia, despite the fact that Britain has comparatively mild winters. A part explanation for this may lie in the quality of our housing stock, which is less thermally efficient than that in most other north European countries and hence may afford less protection against the cold.

This study investigated the relationship between housing and cold-related death. It was based on linking postcoded mortality statistics for the years 1986 to 1996 to housing data from a large national survey carried out in 1991. By linking these two data sets on postcode, it was possible to analyse the seasonal pattern of mortality in relation to the characteristics of housing at the same locations. The research focused on how dwelling characteristics were related to the size of the winter excess of deaths, to indoor temperatures and to specific cold-related mortality.

Seasonal mortality

There was a 23 per cent higher death rate for heart attacks and strokes in winter months (December to March) than in other months of the year. The winter rise in deaths was greatest at older ages, especially among people over 65 years old, but some rise was seen in all age groups. There was little difference in the size of the winter excess in mortality between households of high and low income/socio-economic status.

People living in older properties (which are more difficult to heat) had a greater excess of winter deaths than those living in recently built properties: the lowest risk was seen in people living in dwellings built since 1980, and the highest risk in those living in dwellings built before 1850. There was also an association between excess winter mortality and low indoor temperatures. Homes predicted to be in the lowest quarter of indoor temperatures ('cold homes') had around 20 per cent greater risk of excess winter death than homes in the top quarter of indoor temperatures ('warm homes').

Indoor temperature

There was significant variation in indoor temperature by geographical region (coolest homes in the West Midlands, warmest in London). The main determinants of low indoor temperatures were:

- Age of property (older homes were colder);
- Absence of/dissatisfaction with the heating system;
- Cost of heating the dwelling;
- Low household income;
- Household size.

Table 1 shows the mean measured temperatures for these household and housing characteristics, together with an estimate of the percentage of households

Table 1: Mean measured temperatures

	<i>Mean measured temp. (degrees Celsius)</i>	<i>Per cent of households with predicted hall temp < 16°C at 5°C outside temp.</i>
Age of property		
Pre 1900	17.3	38.8
1900-44	17.5	36.0
1945-64	17.6	35.8
1965-80	19.1	17.6
Post 1980	19.5	14.7
Satisfaction with heating		
Very satisfied	18.5	23.0
Fairly satisfied	17.6	35.7
Fairly unsatisfied	16.8	44.2
Very unsatisfied	16.0	65.1
Minimum standard heating costs		
1 (Lowest quartile)	19.0	20.6
2	17.9	30.7
3	17.6	35.6
4 (Highest quartile)	17.0	41.8
Household net income (quartiles)		
1 (lowest)	17.5	37.3
2	17.6	37.2
3	17.9	31.9
4 (highest)	18.4	22.9
Household size		
1	17.6	38.6
2	17.9	30.9
3-4	18.0	30.4
5+	18.0	28.9

Figure 1: Seasonal fluctuation in mortality



with a hall temperature below 16°C when the outside temperature falls to 5°C.

Housing tenure, being on state benefits, and having a poor thermal efficiency rating were not strongly associated with indoor temperature after these other factors were taken into account. The disadvantage of having a difficult-to-heat home appeared to be greater in households with low income.

Cold-related deaths

Mortality was found to rise by around 2 per cent for each degree Celsius fall in outdoor temperature below 19° Celsius. The increase in mortality with cold was greater in homes predicted to have comparatively low indoor temperatures, though the variation between the warmest and coldest houses was fairly small. Moreover, the marked seasonal fluctuation in mortality was considerably larger in poorly heated homes compared with that in well-heated homes (see Figure 1).

Conclusion

Taken as a whole, the results suggest a credible chain of causation which links poor housing and poverty to low indoor temperatures to cold-related deaths. The three parts of the analysis appear to provide a consistent picture: the seasonal excess of mortality is greatest in dwellings whose characteristics are likely to be associated with poor space heating; temperature

measurements confirm that these same dwelling characteristics are indeed associated with low internal temperatures; and there is evidence that specifically cold-related mortality is greatest in the coldest homes.

The one finding that appears counter-intuitive is the absence of a clear socio-economic gradient in risk of excess winter death. Cardio-vascular and all-cause mortality are known to have a strong association with poverty, but this appears not to be shown by excess winter death. However, a similar proportional rise in winter mortality means that poorer social groups must have a greater absolute rise in winter mortality because of their higher underlying death rate. Moreover, the analyses of indoor temperatures show that, as a whole, residents in the social sector (local authority and housing association dwellings) in fact maintain quite good indoor temperatures, in part because much of the housing stock in this sector is relatively new and easy to heat. However, where a dwelling is expensive to heat and occupied by a household with low income, average internal temperatures are low and the risks of excess winter death high.

In summary, the findings suggest that indoor temperature and factors associated with poor thermal efficiency of dwellings, including property age, are associated with increased vulnerability to winter death from diseases of the heart and circulation. Hence, it is likely that substantial health benefits

could be achieved by measures aimed at improving the thermal efficiency of homes and the affordability of heating them.

Evaluations now beginning of the Government's new Home Energy Efficiency Scheme should provide evidence on this. But wider debate is also needed to consider the forms of housing, energy and social policy that are likely to reduce winter deaths. In particular, consideration needs to be given to the types of energy-efficiency programme and the methods of population targeting that will provide the greatest benefits to public health.

About the project

The study entailed analysis of data from two main data sets: (1) the 1991 English House Conditions Survey conducted by the Department of the Environment, and (2) national mortality data for England, 1986-1996, supplied by the Office for National Statistics. The analyses were based on data for 21,173 dwellings from across England with full or partial housing surveys, to which 179,234 death records were linked by postcode of residence. Of these, 88,331 deaths were from cardiovascular disease (heart attacks, strokes and other diseases of the circulation), 30,467 of which occurred in winter months. The research focused on mortality from cardiovascular disease because such disease has the clearest relationship to ambient temperature. There were three main types of analysis.

- An analysis of variation in the magnitude of excess winter mortality and whether such variation is related to dwelling and household characteristics;
- Tabulation and regression analysis of the factors which determine indoor temperature;
- A time-series analysis of mortality in relation to outdoor temperature — the focus being to examine whether housing and other factors influence cold-related mortality. This analysis was based on a modification of methods more commonly used to investigate the relationship between outdoor air pollution and health.

How to get further information

Further information about this research, including technical details, can be obtained from: Paul Wilkinson, Ben Armstrong or Megan Landon at the Environmental Epidemiology Unit, London School of Hygiene & Tropical Medicine, Keppel Street, London, WC1E 7HT. Email: paul.wilkinson@lshtm.ac.uk, Tel: 020 7927 2103, fax: 020 7580 4524, ben.armstrong@lshtm.ac.uk, Tel: 020 7927 2232 or megan.landon@lshtm.ac.uk, Tel: 020 7927 2442.

The full report, **Cold comfort: The social and environmental determinants of excess winter deaths in England, 1986-1996** by Paul Wilkinson, Ben Armstrong, Megan Landon, and colleagues, is published for the Foundation by The Policy Press (ISBN 1 86134 355 8, price £10.95).